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APPLICATION FOR UNITED STATES LETTERS PATENT FOR MOLDED WALL PANEL AND HOUSE CONSTRUCTION

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MOLDED WALL PANEL AND HOUSE CONSTRUCTION

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This application is a continuation of U.S. Application No. 10/106,152, filed March 26, 2002, which is a continuation of U.S. Application No. 09/293,223, filed April 16, 1999, which is a continuation-in-part application claiming priority to Application Serial No. 08/787,456, filed January 22, 1997, now abandoned. The entirety of each of the priority documents is hereby incorporated by reference.

BACKGROUND AND SUMMARY OF THE INVENTION

[0002] The present invention relates to a modular house construction, and, more particularly, to a molded wall panel for pre-assembled house construction.

Buying a home is one of the most significant investments a consumer can make. Home buyers want to live in a modern home with all the presently available conveniences. Unfortunately, buying a home similar to the one they grew up in, with all the "gingerbread" and detail, has become cost-prohibitive and many home buyers have to settle for homes with which they are not happy.

[0004] Past attempts have been made at decreasing the cost of home construction by prefabricating certain portions of the home off-site. However, known modular house units have failed to provide an equivalent finished home as compared to homes which are built completely on-site. Known prefabricated home units, which may have resulted in initial cost savings, are relatively simple units which do not portray any unique architectural features with respect to other units. Additionally, these known

modular units are not constructed with the equivalent structural integrity and quality as traditionally built homes.

[0005] Accordingly, there is a need for prefabricated wall and roof units and house components which:

are modular;

may be wholly constructed off-site;

may have a resilient exterior which replicates the look of virtually any building material and allows for design flexibility;

have injected insulation;

reduce maintenance requirements;

allow for construction in a quality controlled environment;

allow for wiring harnesses and plumbing designed into the structure; and reduces the cost and time for quality home construction.

The home constructed from the modular house component of the present invention is preferably based on a framework of welded steel and a sheet steel floor deck. In the preferred embodiment, a ceramic, or a resin porcelain laminated, exterior panel is attached to a steel frame. The exterior, or external, panel may be molded to replicate the look of any building material available. The interior walls are preferably dry-walled and painted. Structural insulating foam is preferably injected between the exterior and interior panels. The home constructed from the walls of the present invention may be placed on any type of traditional building foundation.

The wiring harness, plumbing, and HVAC may be designed into the structure. The interior finishes are preferably typical of present housing fixtures: wood trim, cabinets, counter tops, appliances, plumbing fixtures, lighting fixtures, and floor coverings. The roof may also be made of welded structural steel and finished with a resin porcelain laminated exterior panel, molded to replicate the appropriate look of any roofing materials desired. The exterior panel of the present invention is a resilient exterior house wall which:

can be molded to replicate popular building materials and architectural features; is resistant to fire;

maintains interior environmental temperatures better than traditional homes;

is resistant to termites and other rodents;

can be glued to a steel house frame; and

which can be prefabricated in an off-site, quality controlled, environment; and can be repeatedly molded from one manufactured mold.

The exterior, or external, panels are molded and attached, preferably, to steel frames off-site. The steel frames have openings for the insertion of windows and doors, or any other building fixture. The steel frames are preferably welded, off-site, to a framework of upright beams and floor panels. Interior, dry-walled, panels are preferably attached to the steel frames. Foam insulation is preferably injected into the space between the exterior and interior panels. These components, once assembled, define a prefabricated modular house component which may be assembled off-site in a quality controlled environment. Decorative details such as carpet, light fixtures,

decorative borders and wallpaper, cabinets, and electrical outlets may all be installed at the factory. Once completed, the modular house component may be transported to the building site, via truck, where the house component may be easily assembled to the foundation and other modular house components and roof units. Once the foundation has been built, and the modular house component built off-site, the actual house can be assembled on-site within a matter of a few days.

[0009] The prefabricated wall and roof units, and accordingly the modular house components, of the present invention may be constructed in an efficient, quality controlled, environment remote from the building site. The modular house components and roof units may then be transported to the building site for efficient installation. The method of the present invention allows for the construction of homes with unique external architectural features while saving costs and without sacrificing quality.

[0010] In addition to the features mentioned above, objects and advantages of the present invention will be readily apparent upon a reading of the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Novel features and advantages of the present invention, in addition to those mentioned above, will become apparent to those skilled in the art from a reading of the following detailed description in conjunction with the accompanying drawings wherein similar reference characters refer to similar parts and in which:

Figure 1 illustrates a front elevational view of a house of the present invention;

Figure 2 illustrates a frame of the present invention;

Figure 3 illustrates a flowchart for producing wall units of the present invention;

Figure 4 illustrates a cross-sectional view of the layers of a preferred embodiment of a wall unit of the present invention;

Figure 5 illustrates a roof frame of the present invention;

Figure 6 illustrates an elevational view of assembled roof units of the present invention;

Figure 7 illustrates the frame of a modular house component of the present invention;

Figure 8 illustrates a modular house component of the present invention depicting one electrical wiring embodiment;

Figure 9 illustrates an assembled house frame of the present invention;

Figure 10 illustrates a preferred embodiment of a foundation;

Figure 11 illustrates the preferred assembly means for adjacent house components of the present invention;

Figure 12 illustrates the stacking of modular house components of the present invention;

Figure 13 illustrates a preferred assembly means for a house of the present invention;

Figure 14 illustrates another view of the preferred assembly means of the present invention;

Figure 15 illustrates another embodiment of an assembly means for the present invention;

Figure 16 illustrates one embodiment of the roof assembly means of the present invention;

Figure 17 illustrates an elevational view of a exterior panel of the present invention;

Figure 18 illustrates a plan view of a connection-line covering panel of the present invention;

Figure 19 illustrates a house of the present invention;

Figure 20 illustrates how a modular house component may be transported to the building site; and

Figure 21 illustrates how a modular house component may be installed.

DETAIL DESCRIPTION OF PREFERRED EMBODIMENT(S)

The preferred system herein described is not intended to be exhaustive or to limit the invention to the precise forms disclosed. They are chosen and described to explain the principles of the invention, and the application of the method to practical uses, so that others skilled in the art may practice the invention.

[0013] Figure 1 illustrates one embodiment of a house 2 constructed from a prefabricated wall unit 10 of the present invention. The prefabricated wall unit 10 is comprised of a frame 12, and an exterior panel 14 attached to the frame 12. In the preferred embodiment, the exterior panel 14 is comprised of a molded material which replicates known building features and materials. For example, a mold or plug, of a wood panel wall with antique features may be used to produce wood panel replicates.

In another embodiment, a mold depicting a predetermined texture of a roofing material may be used to form external panels **34** of the roofing units **18** of the present invention. Additionally, ornamental architectural features may also be formed integral with the panels **12**, **34**.

[0014] It is preferred that the wall units 10 of the present invention be further comprised of an insulation layer 16 adjacent to the exterior panel 14. In the preferred embodiment, the insulation layer 16 is non-water-based foam material which has been injected into the wall unit 10.

It is preferred that the exterior panel 14 be attached to the frame 12 using an adhesive glue. In the preferred embodiment, the adhesive is a commercially available product called Pliogrip, although there are equivalent products on the market. This adhesive can effectively bond the exterior panel 14 with the steel frame 12. In the preferred embodiment, the external panel 14 is a resin porcelain laminated exterior (for example, a Modar resin or modified acrylic resin). In alternative embodiments, the exterior panel may be made from polymer ceramic composites or fiberglass strands. Exterior panels 14 may be molded from resins and finished with the look of any traditional exterior building materials. The colorization is preferably incorporated into the materials themselves. These exterior panels 14 created with these inert materials are resilient as well as being very resistant to fire. These materials also have excellent environmental advantages over traditional homes as they act to keep the interior air temperature within the home stable with respect to the outside temperature.

Additionally, while replicating the look of any building material, such as wood, the molded exterior panel **14** is resistant to termites and other rodents.

Ising molded external panels 14 allows the builder to construct the wall and roof units in an off-site factory which utilizes a quality controlled process for increasing the quality of construction of the units. The carpenter preparing the positive for the mold of the exterior panel 14 need only be concerned about quality the first time he makes the positive. Subsequently, external panels 14 formed from the mold have the same quality as the positive which was used to form the mold. This has significant advantages over traditional home making done on-site as the exterior panels 14 of the present invention are made with the similar high quality, from the first panel to the last panel produced, whereas the quality of the on-site house construction depends on the skill of the particular carpenter on a particular given day. Once assembled the wall and roof units may be transported to the building site for easy and cost-efficient installation.

[0017] Figure 2 illustrates a frame 12 of the present invention. The frame 12 of the present invention is preferably made from a steel tubing (however the frame 12 and framework of the present invention can alternatively be made of wood, stone, or other equivalent building material). The exterior panel 14 is adhesively attached, or bonded, to the frame 12 using an adhesive glue. Steel anchors may also be used to anchor the exterior panel 14 to the frame 12. These anchors may be spot-welded to the frame 12 for further support. The steel frame 12 of the present invention contains openings 24 of predetermined size, depending on the size of the windows 26 or doors 28 to be placed in that particular opening 24. These openings 24 can be configured to received any

size window 26 or door 28. Unlike traditionally built homes, the windows 26 and doors 28 of the present invention may be directly attached, or hinged, to the frame 12 with an adhesive glue. Traditional homes, built on-site, require additional door or window borders to be built onto the frame requiring additional work and costs. The prefabricated steel frame 12 with predetermined size openings 24 for the fixtures again allows for consistent structural quality and dimensions of each wall unit 10 so the windows 26 and doors 28, which may be standard high quality windows, will fit exactly into the respective openings 24 of the prefabricated steel frames 12. Traditionally built homes do not have these guarantees, even despite higher construction costs, as each frame and each additional window and door border must be built on-site, where there is no stringent quality controlled processes to ensure structural consistency and quality.

[0018] Figure 3 illustrates the process for fabricating the wall units 10 of the present invention. Generally, the fabrication of the wall units 10 of the present invention is accomplished through layering of laminate material which creates an interlinking between each layer, both chemically and mechanically. The properties which come out of this layering arrangement allows for a better R factor and greater hardness and molding characteristics which allows the finished product to look more like the real materials.

The process for producing the prefabricated wall units **10** and roof units **18** is preferably accomplished by: preparing a plug or mold (discussed in more detail below) of a predetermined building feature; filling the mold with a predetermined material (as discussed above) for preparing a molded exterior panel **14** (the mold may

be covered with a layer of wax before filling it to allow easy separation of the hardened molded exterior panel 14 from the mold); removing the molded exterior panel 14 from the mold; and then adhesively attaching, or bonding, the molded exterior panel 14 onto a frame support 12.

The mold is prepared by first constructing a positive of the panel piece. For example, if the constructed house of the present invention is to have brick walls, a positive of a brick wall is first constructed (the size and texture of the bricks used can be varied depending on the tastes of the builder or home buyer). A silicon based mold material is then poured over the positive which is then allowed to cool. Once hardened, the positive is removed from the mold material leaving a mold cavity. Subsequently, any of the materials, or equivalents thereof, discussed above for forming the external panels 14 or roof units 18, may be poured into the mold. Once hardened, the mold is removed from the inserted material leaving a finished external panel piece 14 or roof panel 34.

Specifically, the fabrication process of the present invention is based on a patterned application of predetermined material layers applied to the mold. The pattern preferably follows a grid like pattern with emphasis on high impact areas. These grids increase directional impact characteristics allowing the panel to become a structurally integrated component. These layers integrate to form the molded laminate wall of the present invention.

[0022] The first layering step is comprised of the gel coating and surface coloring layer. The gel coat mixture is preferably comprised of three parts: the gel coat, KZ

Ceramic and catalysts. Application of the gel coat, which is a commercially available product, is preferably sprayed onto the surface of the mold surface. This allows the color of the panel to be impregnated into the surfaces of the finished product. As an example, the total mixture of the gel coat is based on 100% as a starting point. 10% by weight of number 9# KZ Ceramic (from Ceramic Technologies) is mixed into the gel coat. At that point in time, as production starts, 1.5% of the catalysts is mixed into the mixture to oxygenate the resin that makes the mixture harden. This hardening process may take around 45 minutes.

Upon hardening of the gel coat, a first coat of ceramic resin is sprayed uniformly into the mold on top of the hardened gel coat. The second coat is grid sprayed to increase structural characteristics. The material may be sprayed in a grid like pattern (e.g., intersecting lines forming 2 inch squares) by using a modified chopper gun. As one example, the mixture may be 1500 tooling resin at 50% of the total mix, 50% number 6# KZ Ceramic (from Ceramic Technologies), and 3% glass beads, and 1.5% catalysts. The curing process may take 4 to 8 hours to reach full cure. In a preferred process, this layer is then pressed for improving density characteristics of the panel. The ceramic coatings allow for an interlacing between materials which increases the R rating and hardness of the panel.

After the ceramic resin coating has been applied, resin and fiber glass strains may be layered on top. It is preferred that a uniform layer be applied in the first pass of this process. A second pass of the resin and fiber glass mixture is applied in a grid like manner which again improves the structural strength of the panel. In a

preferred embodiment, this layer is applied while the ceramic resin coating layer is curing. Upon placing all the layers into the mold, a male contour "lid" portion of the mold is preferably placed on top of the layers. A vacuum is then applied, preferably to the lid portion, which squeezes the air out of the mold while forcing the "lid" portion to the mold. This air release results in a dense molded material. The mixture of this layer, as an example, may be comprised of: 50% of 814 modar resin, dehydrated alumina (e.g., 11 lbs white and 11 lbs brown). The resin may be promoted with .2% of Dimethyl aniline and .3% of cobalt naphthenate #6, and 1.5% catalyst.

Molds can be created which may replicate any building material. Molds of brick walls, wood walls, stone walls, stucco walls, and any other material can be replicated with the molding process used with the present invention. The external panels 14 created by these molds can be designed to have the look and feel of the building material being replicated. Architectural features such as columns, borders, and even stone statues may be incorporated into the mold so as to produce decorative external panels 14. These molds can be reused to produce panels 14 over and over having the same consistent quality from the first panel to the last produced. As long as the mold is made properly, every exterior panel 14 formed will have the highest quality and consistency. The panels 14 will fit snugly over the steel frames 12 without undesired variations. Accordingly, centuries old Victorian houses can be economically replicated and reproduced using the mold forming process of the present invention. Decorative borders need only be made once, or even stripped from old houses, to be

used as a mold positive for forming exterior panels **14**. The versatility of the new home construction process of the present invention is virtually limitless.

[0026] Figure 4 illustrates a cross-sectional view of the layers of the wall unit 10 of the present invention. An interior panel 30 comprised of a dry-wall construction is bonded to the interior side 20 of the steel frame 12, or on the side opposite the exterior panel 14. The interior panel 30 may be attached to the steel frame 12 at the factory or on-site. The interior panel 30 has all the electrical wiring, phone wiring, fixture and cable outlets built into it. The wiring of the house, established through the chassis of the steel frame 12, corresponds to the outlets contained in the interior wall panel 30. A layer of insulation material may be secured to the inner side 20 of the external panel 14. It is preferred that an insulation foam be injected between the exterior and interior walls panels after they have been bonded to the steel frame 12. The plumbing fixtures and pipes are additionally secured, prefabricated, into the wall unit 10 at the factory site. In another embodiment, certain plumbing fixtures, such as the tub, sink, and toilet, may be molded integrally as part of one of the wall units 10.

The panel 14 is preferably glued to the steel frame 12. Subsequently, this structure is then placed in a press and compressed while injecting insulating foam into the structure. Injecting the foam under pressure prevents the panel 14 from coming off the frame 12 thus increasing the density of the foam insulation layer and improving the structural characteristics of the wall unit.

[0028] Figure 5 illustrates a frame 32 of a roof unit 18 of the present invention. A prefabricated roof unit 18 may be constructed with the same process as the

prefabricated wall unit **10** discussed above. The main difference with the roofs, as opposed to the walls, being the shape of the frame and the roofing molds used for producing the roof units **18** will be different from those used with the wall units **10**. Accordingly, the roof unit **18** of the present invention will, preferably, be comprised of: a frame **32** and an exterior panel **34** attached to the frame **32**. Similar to the wall units **10**, the roof units **18** have exterior panels **34** which are molded to replicate predetermined building materials or roof textiles. These roof units **18** may also be fabricated in an off-site factory, and may be transported to a building site for easy and cost-efficient installation.

It is preferred that the roof unit 18 have a frame comprised of steel. The roof unit 18 has bolt openings 38 for securing each side of the roof (or roof units 18) together. Figure 6 illustrates an elevational view of the pinnacle of the roof unit 18. As depicted, the steel frames 32 of the roof units 18 are bolted together 42 at the top of the roof. A ridge cap 40 is inserted into the top of the roof unit 18 so as to plug the gap between the attached steel frames 32.

[0030] As discussed above, the wall units 10 and the roof units 18 of the present invention are assembled off-site in quality controlled factory environments. The wall units 10 may also be assembled into more complete modular house components 44 at the off-site factory (on-site meaning the actual home building site).

[0031] The modular house component 44 of the present invention is preferably comprised of: a floor panel 46; lateral beams 17; at least two upright beams 48, preferably four, attached to the corners of the floor panel 46; at least one frame 12

(one for each external wall) adhesively attached to the upright beams 48, the frame 12 having a predetermined number of openings 24 for the placement of fixtures such as windows and doors; and an exterior panel 14 adhesively attached to the frame 12, where the exterior panel 14 is molded to replicate a predetermined building material. (Again the frame 12 and exterior panel 14 make up the wall unit 10 of the present invention.) It is preferred that the house component 44 have floor supports 13 (or ceiling supports 15 if it is a top floor component 44). The house components 44 may be attached to each other side-by-side or stacked immediately on top of one another to make a completed house assembly (the assembly discussed in more detail below).

Figure 7 illustrates a stage of construction of a modular house component 44. In Figure 7 a frame 12 has been attached to the structure formed from the lateral beams 17 and at least two upright beams 48. The exterior panel 14 has not yet been secured to the frame 12 in the modular house component of Figure 7 (see also Figures 20 and 21 illustrating the installment of a modular house component 44).

[0033] In the preferred embodiment, the floor panel 46, the lateral beams 17, the frame 12, and the upright beams 48 are comprised of steel. Accordingly, these parts are preferably welded together.

Figure 8 illustrates a perspective view of one modular house component **44** depicting an example wiring embodiment, shown generally at **50**. Again, the wiring of the house component **44** can be done at the off-site factory. Accordingly, the house component **44** can be transported to the building site completely assembled and ready to be connected to the foundation **52** and other modular house components **44**.

Again, in the preferred embodiment, the wall unit **10** of the modular house component **44** has an interior dry-walled panel **30** securably attached to the frame **12**. The modular house component **44** may be completely furbished and decorated at the off-site factory. For example, carpet or hardwood floors may be laid over the floor panel **46**. Decorative borders, wallpaper, and fixtures may be applied to the interior walls **30**. In other words, the house component **44** can be completely manufactured and decorated off-site (similar to a quality controlled automobile factory).

assembled on-site to an already constructed foundation 52 to form a completely assembled house 2. The number of house components 44, the size, and decorative details of each house component 44 will vary on the style of the house 2 and the specific design preferences of the homeowner. However, in the preferred embodiment the house of the present invention comprises: a foundation 52; at least one prefabricated modular house component 44 securably attached to the foundation 52, the prefabricated modular house component 44 having at least one wall unit 10 having a molded external panel 14 comprised of a predetermined ceramic material; and a prefabricated roof unit 18 for attachment to the prefabricated modular house component 44. The details of the assembly of these separate components will be discussed below.

[0037] Figure 9 illustrates a frame structure of a modular house of the present invention. The external panels have not been depicted in the following figures so as to better illustrate the assembly means of the present invention (or in other words, how the

separate house components **44** are attached to each other, the foundation **52**, and the roof units **18**).

Once the modular house components 44 have been delivered to the building site, the first floor modules 44 may be attached to the constructed foundation 52. Industrial cranes are used to hoist the house components 44 into position. Figure 10 illustrates the preferred foundation 52 and the means to attach the house components 44. As depicted in Figure 10, it is preferred that the foundation be a pylon-drilled foundation. (A stone skirt 54 can be attached around the foundation once the house 2 has been assembled). The house components 44 may be adjustably bolted to the foundation 52 as depicted in Figure 10.

[0039] Once the modular components 44 have been attached to the foundation 52 they are preferably secured together. Figure 11 illustrates the preferred means for securing adjacent house components 44. The bolt 56 in Figure 11 securably attaches the house components 44 with respect to each other.

[0040] Two separate modular house components 44 can be stacked immediately on top of each other. Figure 12 illustrates how modular house components are stacked together.

[0041] Modular house components 44 which have been stacked together are preferably bolted to each other. Figure 13 illustrates a close-up view of a cross-section of a house assembly of the present invention depicting the bolting means 58. The lateral beams 17 of stacked modular components 44 are preferably bolted together by the bolts 62. Figure 13 illustrates a wrench 60 inserted through a hole 64 in the lateral

beam 17 used to tighten the bolt 62. The upright beams 48 of adjacent modular house components 44 are preferably secured by bolts 56, 66. Figure 14 illustrates another view of the assembly means of the house 2 of the present invention.

The roof unit 18 of the present invention is also securably attached to the house components 44 by a bolt construction. The frame 32 of the roof unit 18 is bolted to the lateral beam 17 of the top-most modular house components 44 by bolts 68 (see Figure 15). It is also preferred that the roof frame 32 have mounts 70 for accepting bolts 72 from the corner uprights 48. Figure 16 also illustrates a drainage gutter 74 which has been molded as part of the exterior panel 34. This one piece construction is beneficial as drainage gutters have been known to easily become damaged and easily detached from the house structure. The preferred steel frame assembly as described above results in a sturdy house which can withstand much greater loads than traditionally built homes.

between adjacent modular house components 44. A separate panel piece 78 may be form-fitted over the connection line 76. Figure 19 illustrates one embodiment of a completed house 2 constructed from modular house units 44 of the present invention. Houses 2 such as the one depicted in Figure 19 may be assembled on-site within a few days without sacrificing quality while lowering construction costs.

[0044] Having shown and described a preferred embodiment of the invention, those skilled in the art will realize that many variations and modifications may be made to affect the described invention and still be within the scope of the claimed invention.

Thus, many of the elements indicated above may be altered or replaced by different elements which will provide the same result and fall within the spirit of the claimed invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.